Appendix I – Watershed Condition Class & Cumulative Effects Analysis

Part 1 Watershed Condition Class Analysis

Direct and Indirect Effects of SBEADMR Alternatives 2 and 3

Introduction to Watershed Condition Framework

The Forest Service uses a process called the "Watershed Condition Framework" (WCF) to assess overall watershed condition and uses the results to prioritize restoration efforts and track progress toward improving watershed condition on National Forest System (NFS) lands. The process is outlined in the *Watershed Condition Framework and Technical Guide* (USDA Forest Service 2011g and 2011h). Watershed condition is based on a 12-indicator model that considers both aquatic and terrestrial physical and biological indicators. The indicators are grouped into four process categories (Table 1)

Table 1. Indicators in each Watershed Condition Class Process Category

Process Category	Aquatic - Physical	Aquatic - Biota	Terrestrial - Physical	Terrestrial - Biota
Weighting Factor	30 %	30 %	30 %	10 %
Indicators	Water Quality Water Quantity Aquatic Habitat	Aquatic Biota Riparian Vegetation	Roads & Trails Soils	Fire Regime Forest Cover Rangeland Vegetation Terrestrial Invasives Forest Health

Indicators within each Process Category are individually rated according to a standardized rule set, then averaged to give a rating of Class 1 (functioning properly), Class 2 (functioning at risk) or Class 3 (impaired function) for each process category. The Process Category scores are then combined based on a weighting factor to determine a score and condition class for each watershed (Table 2).

Table 2. Watershed Condition Scores and Classes

Watershed Condition Score	Watershed Condition Class	Degree of watershed functionality
1.0 – 1.6	Class 1	Functioning Properly
1.7 – 2.2	Class 2	Functioning at Risk
2.3 – 3.0	Class 3	Impaired Function

A watershed is considered to be functioning properly (Class 1) if the physical attributes are appropriate to maintain or improve biological integrity, i.e. the watershed is functioning in a manner similar to natural

wildland conditions. Class 2 and Class 3 watersheds have impaired function because some physical, hydrological, or biological thresholds have been exceeded. This can occur due to natural processes, such as wildland fire or large slope failures, but are more typically caused by human related disturbance, such as roads close to streams, overgrazing by domesticated animals, invasive species, or presence of aquatic non-native species.

A closer look at Process Categories and Indicators

Each of the twelve indicators is rated based on one or more attributes. Each attribute is rated as 1, 2, or 3 based on the standardized rule set, and the attribute scores are averaged to determine the indicator score. As shown in Figure 1, the distribution of attributes and indicators is not even across the four process categories. So the influence of any one attribute or indicator on the overall process category score depends on the number of other attributes and indicators in that category. For example, the "Impaired Waters" attribute counts as 50 % of the "Water Quality" indicator score, which counts as 33 % of the "Aquatic Physical" process score. And the "Aquatic Physical" score counts as 30 % of the overall watershed condition score.

Figure 1. Core National Watershed Condition Indicators and Attributes
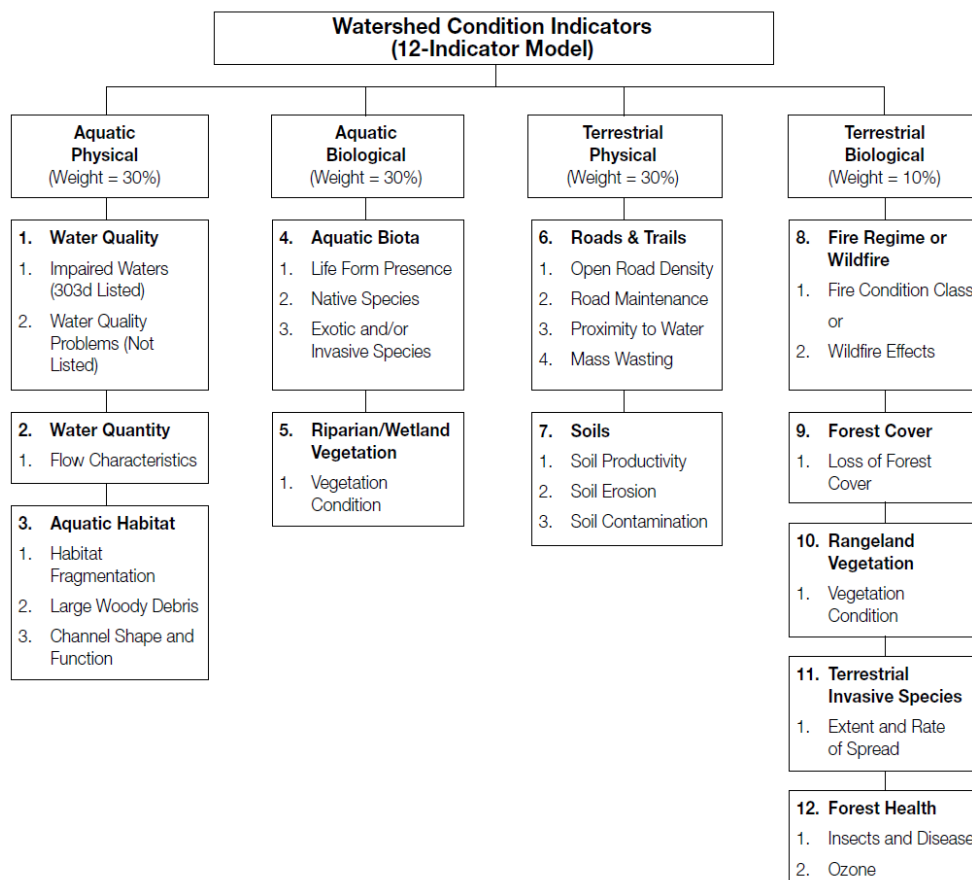

Table 3 show the percent change in overall watershed condition score for a one unit change (from a rating of 1 to 2 or 2 to 3) in each attribute, with all of the other attribute ratings remaining the same. The attributes with the greatest influence on the overall watershed condition score are "Riparian/Wetland

Vegetation Condition" followed by "Water Quantity – Flow Characteristics". The attributes with the least influence are any of those in the "Terrestrial Biological" process category. Note watershed scores are rounded at to the tenths, so to change a Class 1 watershed with a score of 1.6 to a Class 2 watershed with a score of 1.7 requires at least a 3 percent change in the watershed score (.05/1.6*100). And to change a Class 1 watershed with a score of 1.5 to a Class 2 watershed with a score of 1.7 requires at least a 7 percent change in watershed score (1.1/1.54*100).

Table 3. Percent change in overall watershed condition score for a one unit change in an attribute

Process Category	Indicators	Attributes	Percent Change in overall Watershed Condition Score
Aquatic Physical	Water Quality	Impaired waters	3 - 4
		Water quality problems not listed	3 - 4
	Water Quantity	Flow characteristics	6
	Aquatic Habitat	Habitat fragmentation	2
		Large woody debris	2
		Channel shape and function	2
Aquatic Biological	Aquatic Biota	Life form presence	3 - 4
		Native species	3 - 4
		Exotic and/or invasive species	3 - 4
	Riparian/Wetland Vegetation	Vegetation Condition	10
Terrestrial Physical	Roads and Trails	Open road density	2 - 3
		Road and trail maintenance	2 - 3
		Proximity to water	2 - 3
		Mass wasting	2 - 3
	Soils	Soil productivity	3
		Soil erosion	3
		Soil contamination	3
Terrestrial Biological	Fire Regime or Wildfire	Fire Regime	1
		Wildfire	
	Forest Cover	Loss of forest cover	1
	Rangeland Vegetation	Rangeland vegetation condition	1
	Terrestrial Invasive Species	Extent and rate of spread	1
	Forest Health	Insects and disease	0.5
		Ozone	0.5

Direct and Indirect Effects of SBEADMR Treatments on WCF Attributes

SBEADMR treatments include mechanical harvest of green and dead trees – primarily spruce and aspen, construction and reconstruction of roads to access commercial treatment areas, mechanical and hand fuels treatment, and broadcast and pile burning. Below is a general discussion of the potential direct and indirect effects of the SBEADMR treatments on water quality and soil resources given the following analysis assumptions:

- Forest Plan Standards and Guidelines, Watershed Conservation Practices, and National Core Best Management Practices will be followed

- The Pre-treatment Checklist will be completed to identify sensitive features such as fens and wetlands, Water Influence Zones (WIZ), highly erodible soils, and steep slopes in order to prescribe design features to avoid, minimize, or mitigate adverse effects to water quality and soil resources. Design features would be implemented as designed. Project will follow state and   federal laws; especially regarding construction in or near waterways and wetlands to control erosion.

- Sedimentation is the water-quality impairment most likely to result from the proposed activities. Roads, especially in close proximity to water are the dominant vector for sediment delivery to stream channels or wetland/fen resources.

- Potential changes in water yield are not quantifiable and will be based on the   percentage of tree mortality within the watershed more than tree removal.

Mechanical Salvage Harvest, Resiliency Harvest, Hazard Tree Removal, Non-commercial Cutting, and Coppice Cuts

Tree removal with mechanical harvest equipment disrupts soil surface structure and compacts   soil in skid trails. Mechanical harvest equipment use is restricted to the outer half of WIZs bordering fens, wetlands, and stream channels, although equipment can reach into these areas. Harvest of beetle-killed trees could increase soil   moisture, groundwater recharge, and plant available nutrients.

Use of design features and BMPs will reduce the potential for compaction and erosion. Objectives for specific design features are noted in the design feature list. Treatment-specific   design features will be selected by a GMUG resource specialist during pre-implementation   analysis. Examples of appropriate design features for this type of activity include but are not   limited to:

- Maintaining or restoring ground cover to reduce erosion potential (WQSP-1).

- Keeping heavy equipment in the outer half of the WIZ and outside fens and wetlands to minimize damage (WQSP-4).

- Operating heavy equipment when the soil is dry or over a minimum one foot of snow to reduce soil compaction (WQSP-5, WQSP-9A).

The effects of individual treatments are likely to be minor to moderate and moderate term.

Road Construction and Reconstruction

Road construction creates soil compaction and potentially impacts nearby streams. Roads can cause changes in surface and shallow subsurface hydrology and are often a major source of sediment to streams (Megahan 2000). Increases in road density and the number of road-stream crossings increase the potential for sediment delivery to streams and in changes to stream channel morphology.

A transportation/road system has been developed on paper to implement the SBEADMR project. The existing road network would be used to the maximum extent possible to access the proposed treatments and to remove forest products. For commercial treatments, existing roads would be supplemented by constructing new roads only when necessary. No road construction is proposed for noncommercial treatments. Where necessary for resource protection, existing roads would be reconstructed. Per Forest Plan direction, there would be no increase in open road density.

A total mileage estimate for road construction is provided. Expected actions for roads include vegetation clearing, excavation and/or embankment, blading and shaping, out-sloping, drainage dips, and water-spreading ditches, and may include importing of armoring and surfacing rock material as needed. More embankment and drainage structures would be utilized when there are adjacent resource concerns (perennial and intermittent stream crossings, high soil erosion hazard, steeper side slopes, etc.). Note that because all new roads in the action alternatives would be decommissioned within 5 years of the closure of the associated SBEADMR timber sale, all road construction analyzed in SBEADMR is temporary.

Some existing roads located within WIZs or other sensitive areas may be moved and erosion control measures improved to reduce impacts to riparian areas and provide a beneficial effect to watersheds. New roads would be designed and constructed with design features and BMPs implemented to reduce potential impacts. Pre-implementation surveys would identify WIZs, fens, wetlands, and geologically unstable areas in the proposed treatment areas. Locating roads outside of WIZs, fens and wetlands allows ground surface cover to act as a filter to eroded material and keep sediment out of waterbodies.

Examples of appropriate design features for this type of activity include but are not limited to:

- New designed and temporary road construction would not increase overall disturbance within the watershed to more than 25 percent of the watershed area (WQSP-10).

- Proposed roads would be located outside of fens and wetlands, and to the extent feasible, WIZs (WQSP-2, WQSP-4).

- Stream crossings would be minimized and constructed according to Forest Service standards to minimize negative impacts to stream channels and aquatic habitat (WQSP- 3A).

- All new roads would be decommissioned within five years of harvest being completed (WQSP-8A, WQSP-8B).

The effects of new roads would likely be minor and short-term.

Reconstruction generally includes work to improve and restore roads, or to bring them back up to the original design standard. Improvements would provide for serviceability for project haul vehicles, as well as for proper hydrologic function and stream protection in accordance with applicable Best Management Practices. Actions can include surface improvement; construction of drainage dips, culverts, riprap fills or other drainage or stabilization features with potential disturbance outside the

established roadway (toe of fill to top of cut); realignment; and widening of curves as needed for log trucks and chip van passage. Reconstruction includes the replacement of unsustainable existing roads with new, designed roads, as well as decommissioning of the prior road. Road reconstruction can improve watershed condition.

All new roads, and existing non-system roads used for SBEADMR, would be decommissioned within five years of harvest being completed. Road decommissioning involves removing bridges and culverts, eliminating ditches, out-sloping the roadbed, contouring to re-establish the natural undisturbed slope, scarifying of the road surface to reduce compaction, promoting native vegetation, removing ruts and berms, effectively blocking the road to normal vehicular traffic where feasible under existing terrain conditions, and building cross ditches and water bars. When bridges and culverts are removed, associated fills shall also be removed to the extent necessary to permit normal maximum flow of water and reconstruction of the floodplain and stream channel as needed. These actions would restore hillslope drainage patterns to near pre-disturbance conditions and encourage re-establishment of ground cover on the road prism to reduce erosion potential to near pre-disturbance conditions.

Mechanical and Hand Fuels Treatments

Mechanical fuels treatment consists of mastication. Masticators are heavy pieces of equipment that shred understory vegetation and small trees and which are typically driven over the masticated material which reduces ground disturbance and soil compaction. The shredded vegetation remains on the soil surface, which minimizes or eliminates erosion. Masticated material is typically burned within a few years, which releases nutrients to the soil.

Examples of design features appropriate for this type of activity include, but are not limited to:

- Operating heavy equipment on dry soils to minimize soil compaction (WQSP-9A).

- Leaving 80 percent cover in WIZs (WQSP-2).

- Avoiding operating equipment in fens and wetlands (WQSP-4).

Hand treatments, which include thinning or pruning with chain saws, and hand piling and burning slash, create virtually imperceptible disturbance at the watershed level.

Broadcast and Pile Burning

Broadcast burning is a prescribed fire technique that creates patchy, low to moderate severity impacts to surface soils. Burning is conducted when soils and fuels have higher moisture levels which reduce fire impacts to soils. Patchy burn patterns leave relatively bare areas surrounded by unburned or slightly burned areas with sufficient cover to reduce runoff and erosion potential. This type of broadcast burning has effects which are generally localized, minor and short-term (McIver 2013, Erickson 2008).

Broadcast burning will conducted to create suitable conditions for aspen regeneration. Damage to soils can occur where the fire burns hotter or for longer time periods, such as where fuels are larger or denser. Where fire severity is high, the fire may burn all surface cover in some areas, can create areas of water repellent soils, and damage the soil biotic community. These areas are typically patchy and surrounded by areas of partial soil cover and less damaged soil, which reduces the potential for significant erosion and allows the soil to recover.

Pile burns can damage soil structure, productivity, and soil biota, but can be effectively rehabilitated through scarification and mulching (Jiménez Esquilín 2007, Fornwalt 2011). To keep impacts to soils to a minimum, pile size would be limited with larger piles allowed only on landings and smaller piles in the interior areas of treatment units. The total area covered by piles/acre would be kept under ~5% (<2,500 square feet/acre covered by piles). This restriction on size and area of piles would ensure the extent of soil affected would be less than 15% of an activity area. In addition, piles built by machine would be constructed in such a manner encourage efficient burning and combustion. Following completion of burning, a sample of pile burn scars would be monitored within three years for extent of impacts and would be rehabilitated as needed. Pile burns effects will be localized, moderate, and short-term.

Examples of design features appropriate for these types of activities include, but are not limited to:

- Limit the size, composition, and aerial extent of slash piles to minimize effects to soils from pile burns (SP-4).

Below is a general discussion of the potential direct and indirect effects of the SBEADMR treatments on each of the WCF attributes:

Aquatic Physical

Water Quality

The "Water Quality" indicator has two attributes: "Impaired waters (303(d) listed)" and "Water quality problems (not listed)". For the "Impaired waters" attribute, the distinction between a 1, 2, or 3 rating is the extent of State-listed impaired or threatened waterbodies. No listed waterbodies is given a rating of "1", < 10 % of stream miles or lake acres listed is given a rating of "2", and > 10 % of stream miles or lake acres listed is given a rating of "3". For the "Water quality problems" attribute, the distinction between a 1, 2, or 3 rating is documented water quality problems such as fish consumption advisories, contamination from active or abandoned mines, and incidence of accelerated erosion, nutrients, chemicals, or contamination of public water supplies. Minor or no water quality problems is given a rating of "1", moderate water quality problems is given a rating of "2", and extensive water quality problems is given a rating of "3".

The major pollutant generated by SBEADMR treatments would be sediment. Most of the current 303(d) listed waterbodies in the SBEADMR affected watersheds are impaired by metals. SBEADMR treatments would not add metal pollutants to these waterbodies. Accelerated erosion and sediment delivery to a waterbody could lead to impairment from sediment. Colorado has a narrative sediment standard that requires waterbodies to be "free from sediment deposits detrimental to classified uses". The affected area would need to be rather extensive and the sediment delivery such that sediment deposits would adversely impact aquatic life in order for a waterbody to be listed. Design features and other BMPs used during SBEADMR treatments would limit the amount of soil erosion and delivery to waterbodies. It is not likely the SBEADMR treatments would lead to sediment impairments, and change the "Impaired waters" attribute.

Similarly, for a change in rating for the "Water quality problems" attribute, there would need to be a rather extensive area of accelerated erosion and sediment delivery to go from "no or minor" documented sediment problems to "moderate" or from "moderate" to "major". Design features and other BMPs used during SBEADMR treatments would limit the amount of soil erosion and delivery to waterbodies. It is not likely the SBEADMR treatments would lead to extensive sediment delivery to waterbodies, and change the "Water quality problems" attribute.

Water Quantity

The "Water Quantity" indicator has one attribute: "Flow characteristics". This attribute addresses changes to the natural flow regime with respect to the magnitude, duration, and timing of natural streamflow hydrographs, primarily as affected by man-made reservoirs, dams, or diversion facilities. While the SBEADMR treatments may result in measureable increases in water yield at the stand scale, these changes to the flow regime would not be observable at the watershed scale. None of the SBEADMR treatments would create new, or affect the operation of existing, reservoirs, dams, or diversions. There would be no change to the "Flow characteristics" attribute or "Water Quantity" indicator from SBEADMR treatments.

Aquatic Habitat Conditions

The "Aquatic Habitat Conditions" indicator has three attributes: "Habitat fragmentation", "Large woody debris", and "Channel shape and function". The "Habitat fragmentation" attribute concerns breaks in aquatic habitat caused by temperature, aquatic organism passage blockages or dewatering. A watershed where more than 95 percent of historic aquatic habitats are still connected is given a rating of "1", 25 to 95 percent of historic aquatic habitats are still connected is given a rating of "2", and less than 25 percent of historic aquatic habitats are still connected is given a rating of "3". SBEADMR treatments that remove canopy cover in the WIZ could affect water temperature, however, machine use to extract the trees would be limited to the outer half of the WIZ (WQSP-2) reducing the number of trees removed from the WIZ, also most of the trees removed would be dead and not providing as much shade as would a live tree. Effects to water temperature from SBEADMR treatments would be minor. New road/stream crossings could block aquatic organism passage, however, stream crossings are to be designed to sustain bankfull stream dimensions and pass normal flows (WQSP-3A) and stream crossings would be decommissioned within 5 years after harvest. Effects to aquatic organism passage should be minor and temporary. SBEADMR treatments would not increase stream dewatering in any watershed. In addition, the range of connected historic aquatic habitat rated as "2" is fairly large (25 to 95 percent) such that it would take a habitat disconnection low in the watershed to move a watershed from a "2" to a "3" for this attribute. That would be unlikely from SBEADMR treatments. There should be little change in the "Habitat fragmentation" attribute from SBEADMR treatments.

The "Large woody debris" attribute is concerned with the lack of large wood in stream systems and changes due to riparian management activities that would reduce large wood recruitment. In the case of SBEADMR, large woody debris and recruitment would not be a concern in the affected watersheds due to the high mortality from the spruce beetle and aspen decline.

The "Channel shape and function" attribute is concerned with channel width-to-depth ratios and floodplain connectivity. Aside from new road/stream crossings, there would be no effect to width-to-depth ratios or floodplain connectivity from SBEADMR treatments as the WIZ would provide a buffer from direct impacts to stream channels. Stream crossings are to be designed to sustain bankfull stream dimensions and pass normal flows (WQSP-3A) and stream crossings would be decommissioned within 5 years after harvest. Effects to channel geomorphology should be minor and temporary and not result in a change to the "Channel shape and function" attribute.

Aquatic Biological

Aquatic Biota

The "Aquatic Biota" indicator has three attributes: "Life form presence", "Native species", and "Exotic and/or aquatic invasive species". These attributes address the distribution, structure, and density of native and introduced aquatic fauna. With the BMPs and design features, there would be no effects to native

aquatic fauna or exotic or aquatic invasive species from SBEADMR treatments such that any of these three attributes or the "Aquatic Biota" indicator would change.

Riparian/Wetland Vegetation Condition

The "Riparian/Wetland Vegetation Condition" indicator has one attribute: "Vegetation condition". This attribute addresses the function and condition of native riparian vegetation along streams, waterbodies, and wetlands. A watershed where more than 80 percent of the riparian/wetland areas is dominated by native mid to late seral vegetation that is vigorous, healthy, and diverse in age, structure, cover, and composition is given a rating of "1". A watershed with 25 to 80 percent of the riparian/wetland areas with such vegetation condition is given a rating of "2", and less than 25 percent of the riparian/wetland areas with such vegetation condition is given a rating of "3". This attribute/indicator has the greatest weight in the overall watershed condition score so a change in this attribute alone from SBEADMR treatments could potentially change the watershed condition class.

SBEADMR treatments would not affect fen or wetland vegetation condition as these areas would be avoided. Overall riparian vegetation community condition is likely to be more affected by the spruce beetle and sudden aspen decline mortality than from the SBEADMR treatments themselves. However, there is some potential for equipment traffic in the outer half of the WIZ, which could affect riparian vegetation, and there could be some tree cutting in the inner portions of the WIZ. The potential for SBEADMR treatments to affect the "Riparian/Wetland Vegetation Condition" would depend on the extent that SBEADMR treatment areas overlap with riparian areas. To change the rating for this attribute would require an extensive aerial amount (greater than 25 percent) of impact to riparian vegetation in a watershed due to the percentages in the rule set.

Terrestrial Physical

Roads and Trails

The "Roads and Trails" indicator has four attributes: "Open road density", "Road and trail maintenance", "Proximity to water", and "Mass wasting". This indicator addresses changes to the hydrologic and sediment regimes due to the density, location, distribution, and maintenance of the road and trail network. Both SBEADMR action alternatives include new temporary or designed road construction to access commercial priority treatment areas, road reconstruction and road maintenance. The road reconstruction and road maintenance associated with SBEADMR would generally be a benefit to watershed condition as road drainage and surface stabilization would be improved and, in some cases, roads located near waterbodies would be moved to outside the WIZ. New road construction could have a detrimental effect on watershed condition and "Roads and Trails" attributes depending on road design and location. New roads could increase the "Open road density" in a watershed, however this would be a temporary effect as all roads would be decommissioned within 5 years after harvest is completed. And there Forest Plan direction is that there would be no increase in open road density. There would be unavoidable road construction in the WIZ at road/stream crossing locations but road locations within the WIZ would be avoided where practicable. Pre-treatment checklist would be used to identify appropriate road locations and design to minimize impacts. Also the pre-treatment checklist would identify areas subject to mass wasting so that these areas could be avoided when locating roads. SBEADMR roads could potentially adversely affect the "Roads and Trails" attributes and indicators depending on the amount of new roads built in a watershed and their proximity to waterbodies. In order to change the overall watershed condition score, however, more than one of these attributes would need to change in the negative direction because of the small influence any one of these attributes alone has.

Soils

The "Soils" indicator has three attributes: "Soil productivity", "Soil erosion", and "Soil contamination". This indicator addresses alteration to natural soil condition, including productivity, erosion, and chemical contamination. These attributes are rated based on the extent of alteration to reference soil condition that is evident in the watershed. Minor or no alterations are rated as "1", moderate amounts of alterations are rated as "2", and significant alteration is rated as "3". As noted above, SBEADMR treatments have the potential to affect soil properties including compaction, porosity, infiltration, bulk density, organic matter, and soil cover. However, the design features included in the project design and implementation would limit the areas of detrimental impact to less than 15 percent of each activity area, which is the threshold limit in the Watershed Conservation Practices Handbook. SBEADMR treatments are unlikely to change any of the "Soils" indicator attributes.

Terrestrial Biological

Fire Regime or Wildfire

The "Fire Regime or Wildfire" indicator has two attributes but only one of them is rated for a watershed: "Fire Regime Condition Class" or "Wildfire Effects". This indicator addresses the potential for altered hydrologic and sediment regimes because of departures from historical ranges of variability in vegetation, fuel composition, fire frequency, fire severity, and fire pattern. Either the "Fire Regime" or "Wildfire Effects" attribute, but not both, is rated for each watershed. All watersheds on the GMUG were rated for "Fire Regime Condition Class". A watershed would not be rated for "Wildfire Effects" unless a significant wildfire were to occur.

From the DEIS/FEIS: "there is some consensus that 'fire regimes in the subalpine zone of the Rocky Mountain region are driven primarily by fire weather' (Sibold et al. 2006). That being said, fuels must still be present in an amount and configuration that supports fire establishment on the landscape when weather is conducive for fires to occur. Current stand conditions in spruce across much of the GMUG are adequate to support significant fire intensity and fire size, or are approaching those stand conditions due to age and successional processes. Unlike other more mesic ecotypes which have experienced a fuels buildup since fire suppression activities began to exert influence in the 1900's, fire regimes in spruce have not been affected as much as those in lower elevation, more mesic vegetation types (Sibold et al. 2006). However, comparisons of historic photos to present conditions do suggest changes in stand condition that would lead to higher severity fires. Stands were more open, with much more diversity of sizes and ages; small openings were much more frequent. On a multi-stand or landscape scale in spruce/fir, there is more continuity of older age classes, or juxtaposition of older age classes against other older age classes, due to a decrease in fire disturbance on the landscape over the past one hundred plus years. This condition of increasing continuity of older age classes in spruce/fir is not as significant as found in more mesic forest types at lower elevations but is beginning to manifest itself in the widespread nature of the current beetle outbreak and could well manifest itself in future years as very large fires such as occurred on the Rio Grande National Forest in 2013 (see 'Historic Fires' discussion below)."

Given this explanation, the "Fire Regime Condition Class" attribute is driven more by climate and fire weather than vegetation treatments. SBEADMR treatments would be designed to reduce fuels such that any fires that do occur would be less difficult to suppress and would result in lessened impacts to watersheds and soil. SBEADMR treatments are not likely to change the "Fire Regime Condition Class" in the negative direction, and if there were to be any effect, it would be more likely to be in the positive direction.

Forest Cover

The "Forest Cover" indicator has one attribute: "Loss of forest cover". This attribute/indicator addresses the potential for altered hydrologic and sediment regimes because of the loss of forest cover on forest lands. A watershed where less than 5 percent of NFS land contains cut-over, denuded, or deforested forest land is given a rating of "1". A watershed with 5 to 15 percent of NFS land is in such condition is given a rating of "2", and greater than 15 percent of the NFS land is in such condition is given a rating of "3". SBEADMR treatments include commercial timber harvest and non-commercial vegetation management prescriptions that would potentially affect the extent of forest cover in the watershed. However, treated areas would not be left in "cut-over, denuded, or deforested" condition. Treatment units and prescriptions would be designed to encourage natural revegetation where possible and tree planting would be initiated in areas where natural revegetation is insufficient to meet post-harvest stocking requirements. SBEADMR treatments would not result in a change of rating for this attribute/indicator.

Rangeland Vegetation

The "Rangeland Vegetation" indicator has one attribute: "Rangeland vegetation condition". This attribute/indicator addresses impacts to soil and water relative to the vegetative health of rangelands. The SBEADMR treatments would not affect rangeland vegetation condition and therefore would not result in a change of rating for this attribute/indicator.

Terrestrial Invasive Species

The "Terrestrial Invasive Species" indicator has one attribute: "Extent and rate of spread". This attribute addresses potential impacts to soil, vegetation, and water resources due to terrestrial invasive species including vertebrates, invertebrates, and plants. SBEADMR treatments are unlikely to increase the extent or rate of spread of vertebrate and invertebrate terrestrial invasive species, however invasive plants could be introduced or spread from road construction, timber harvest, vegetation treatments, and burning. Design features including measures to wash and inspect vehicles, inventory of treatment areas, unit design, use of weed-free seed mixtures for revegetation of disturbed areas, and post-disturbance monitoring and treatment would reduce the potential introduction, spread and establishment of invasive plants that could occur as a result of SBEADMR treatments. Even with these design features, it is likely that new populations of invasive plants will become established. However, to change the attribute rating, the extent of the new or expanded infestation would need to affect more than 10 percent of the watershed area. A watershed where less than 10 percent of the area is infested is given a rating of "1". A watershed with 10 to 25 percent of the area infested is given a rating of "2", and greater than 25 percent of the area infested is given a rating of "3". SBEADMR treatments are unlikely to result in a change of rating for this attribute/indicator.

Forest Health

The "Forest Health" indicator has two attributes: "Insects and disease" and "Ozone". This indicator addresses forest mortality impacts to hydrologic and soil function due to major invasive and native forest pest, insect, and disease outbreaks, and air pollution. These attributes have the least influence on the overall watershed score. The "Insects and disease" attribute addresses the percent of the forested land within a watershed that is experiencing, is at imminent risk of experiencing, abnormally high levels of tree mortality from insects and disease. Nearly all of the watersheds on the GMUG are already rated as "3" for this attribute from the current spruce beetle outbreak and sudden aspen decline. SBEADMR treatments would not affect this attribute. The "Ozone" attribute addresses the loss of biomass growth from ozone effects. SBEADMR treatments would not affect the levels of ozone across the GMUG so would not change this attribute. The "Forest Health" indicator would not change because of SBEADMR treatments.

Direct and Indirect of SBEADMR Treatments on Watershed Condition in Affected Watersheds.

The GMUG reclassified watershed condition class as part of a 2011 national effort. The identified priority treatment areas and hazardous tree removal corridors lie within 188 watersheds on the GMUG. Of these, 116 are Class 1; 70 are Class 2, no watersheds are Class 3, and 2 are watersheds where watershed condition was not rated because of the small percentage of NFS land within them (USDA Forest Service 2011h). Of the 116 Class 1 watersheds, 42 have a Watershed Condition Class score of 1.6 and are at a higher risk of moving from Class 1 (Functioning Properly) to Class 2 (Functioning at Risk) due to natural (wildland fire) or human (roads or timber harvest) causes. These are called borderline Class 1/Class 2 watersheds. The highest watershed condition score of any GMUG watershed is a "2" so there are no Class 2/Class 3 borderline watersheds.

Given the above discussion on the influence of each WCF attribute on the overall watershed condition score and the potential effects of the SBEADMR treatments on each WCF attribute, the greatest potential for a change in watershed condition class from SBEADMR treatments would be a change to the "Riparian/Wetland Vegetation" and/or "Roads and Trails" indicators in the borderline watersheds. For watersheds that are solidly Class 1 (a score of 1.5 or less) or are already Class 2 (a score of 1.7 or greater), SBEADMR treatments are unlikely to change the ratings of WCF attributes such that the overall watershed condition score would change sufficiently to change the condition class from 1 to 2 or 2 to 3. The effects of SBEADMR treatments on indicators/attributes other than "Riparian/Wetland Vegetation" and "Roads and Trails" are unlikely to change those ratings. Therefore this analysis will focus only on the "Riparian/Wetland Vegetation" and "Roads and Trails" indicators in the borderline watersheds.

Borderline Watersheds

Table 4 lists the "borderline" watersheds, their process category scores, and the amount of SBEADMR treatments in both Alternative 2 and Alternative 3.

Table 4. Borderline watersheds with process category scores and area of SBEADMR treatments.

HUC12_Code	HUC12_Name	Aq Phys Score (30 %)	Aq Bio Score (30 %)	Terr Phys Score (30 %)	Terr Bio Score (10 %)	Alt 2 Treatments	Alt 3 Treatments
Grand Mesa Geographic Area							
140100051102	Headwaters Buzzard Creek	1.3	2.2	1.4	1.2	C: 0 ac NC: 2287 ac (11 %) HTR: 102 ac (< 1 %) RDS: 0 ac Total: 2389 ac (11 %)	C: 0 ac NC: 2256 ac (11 %) HTR: 102 ac (< 1 %) RDS: 0 ac Total: 2358 ac (11 %)
140100051201	Leon Creek	1.6	1.7	1.4	1.4	C: 619 ac (2 %) NC: 0 ac HTR: 170 ac (< 1 %) RDS: 0 ac Total: 789 ac (3 %)	C: 0 ac NC: 0 ac HTR: 220 ac (< 1 %) RDS: 0 ac Total: 220 (< 1 %)
Gunnison Basin North Geographic Area							
140200010111	Bear Creek-Spring Creek	1.4	2.2	1.4	1.4	C: 1242 ac (5 %) NC: 0 ac HTR: 61 ac (0 %) RDS: 3 ac (0 %) Total: 1306 ac (6 %)	C: 480 ac NC: 0 ac HTR: 92 ac RDS: 1 ac (< 1 %) Total: 573 ac (3 %)

Appendix I – Watershed Condition Class & Cumulative Effects Analysis
Spruce Beetle Epidemic and Aspen Decline Management Response

HUC12_Code	HUC12_Name	Aq Phys Score (30 %)	Aq Bio Score (30 %)	Terr Phys Score (30 %)	Terr Bio Score (10 %)	Alt 2 Treatments	Alt 3 Treatments
140200010112	Beaver Creek	1.2	2.2	1.4	1.4	C: 0 ac NC: 7920 ac (43 %) HTR: 0 ac RDS: 0 ac Total: 7920 ac (43 %)	C: 0 ac NC: 5425 ac (30 %) HTR: 12 ac (< 1 %) RDS: 0 ac Total: 5437 ac (30 %)
140200010202	Brush Creek	1.2	2.2	1.5	1.2	C: 0 ac NC: 0 ac HTR: 258 ac (1 %) RDS: 0 ac Total: 258 ac (1 %)	C: 0 ac NC: 0 ac HTR: 258 ac (1 %) RDS: 0 ac Total: 258 ac (1 %)
140200021003	Corral Creek-Gunnison River	1.2	1.9	1.7	1.3	C: 0 ac NC: 0 ac HTR: 120 ac (< 1 %) RDS: 0 ac Total: 120 ac (< 1 %)	C: 0 ac NC: 0 ac HTR: 120 ac (< 1 %) RDS: 0 ac Total: 120 ac (< 1 %)
140200020705	Cow Creek-Soap Creek	1.3	2.2	1.3	1.6	C: 0 ac NC: 0 ac HTR: 115 ac (< 1 %) RDS: 0 ac Total: 115 ac (< 1 %)	C: 0 ac NC: 0 ac HTR: 115 ac (< 1 %) RDS: 0 ac Total: 115 ac (< 1 %)
140200010108	Lottis Creek	1.2	2.2	1.5	1.2	C: 0 ac NC: 0 ac HTR: 57 ac (0 %) RDS: 0 ac Total: 57 ac (0 %)	C: 0 ac NC: 0 ac HTR: 57 ac (0 %) RDS: 0 ac Total: 57 ac (0 %)
140200010210	Lower East River	1.3	2.2	1.5	1.2	C: 0 ac NC: 0 ac HTR: 57 ac (0 %) RDS: 0 ac Total: 57 ac (0 %)	C: 0 ac NC: 0 ac HTR: 57 ac (0 %) RDS: 0 ac Total: 57 ac (0 %)
140200010113	Lower Taylor River	1.6	1.7	1.4	1.4	C: 0 ac NC: 4348 ac (11 %) HTR: 25 ac (0 %) RDS: 0 ac Total: 4373 ac (11 %)	C: 0 ac NC: 3950 ac (10 %) HTR: 45 ac (0 %) RDS: 0 ac Total: 3995 ac (10 %)
140200010203	Middle East River	1.3	2.2	1.4	1.4	C: 617 ac (4 %) NC: 0 ac HTR: 86 ac (< 1 %) RDS: 6 ac (0 %) Total: 709 ac (4 %)	C: 617 ac (4 %) NC: 0 ac HTR: 86 ac (< 1 %) RDS: 6 ac (0 %) Total: 709 ac (4 %)
140200010106	Outlet Willow Creek	1.4	2.2	1.4	1.4	C: 0 ac NC: 0 ac HTR: 115 ac (< 1 %) RDS: 0 ac Total: 115 ac (< 1 %)	C: 0 ac NC: 0 ac HTR: 115 ac (< 1 %) RDS: 0 ac Total: 115 ac (< 1 %)
140200010201	Upper East River	1.6	1.7	1.7	1.2	C: 0 ac NC: 0 ac HTR: 22 ac (0 %) RDS: 0 ac Total: 22 ac (0 %)	C: 0 ac NC: 0 ac HTR: 22 ac (0 %) RDS: 0 ac Total: 22 ac (0 %)

HUC12_Code	HUC12_Name	Aq Phys Score (30 %)	Aq Bio Score (30 %)	Terr Phys Score (30 %)	Terr Bio Score (10 %)	Alt 2 Treatments	Alt 3 Treatments
140200040301	Ruby Anthracite Creek	1.4	1.7	1.7	1.4	C: 513 ac (2 %) NC: 0 ac HTR: 11 ac (0 %) RDS: 5 ac (0 %) Total: 529 ac (2 %)	C: 481 ac (2 %) NC: 0 ac HTR: 11 ac (0 %) RDS: 5 ac (0 %) Total: 492 ac (2 %)
Gunnison Basin South Geographic Area							
140200030503	Archuleta Creek	1.4	1.9	1.4	1.4	C: 2181 ac (6 %) NC: 0 ac HTR: 518 ac (1 %) RDS: 15 ac (0 %) Total: 3604 ac (8 %)	C: 0 ac NC: 0 ac HTR: 545 ac (1 %) RDS: 0 ac Total: 545 ac (1 %)
140200030504	Headwaters Los Pinos Creek	1.4	2.2	1.4	1.4	C: 5440 ac (17 %) NC: 1729 ac (5 %) HTR: 622 ac (2 %) RDS: 7 ac (0 %) Total: 7798 ac (25%)	C: 0 ac NC: 0 ac HTR: 1279 ac (4 %) RDS: 0 ac Total: 1279 ac (4 %)
140200020602	Lake San Cristobal-Lake Fork	1.7	1.7	1.5	1.2	C: 0 ac NC: 0 ac HTR: 17 ac (0 %) RDS: 0 ac Total: 17 ac (0 %)	C: 0 ac NC: 0 ac HTR: 17 ac (0 %) RDS: 0 ac Total: 17 ac (0 %)
140200020802	Little Blue Creek	1.4	2.2	1.4	1.2	C: 1161 ac (5 %) NC: 0 ac HTR: 66 ac (0 %) RDS: 2 ac (0 %) Total: 1229 ac (6 %)	C: 21 ac (0 %) NC: 0 ac HTR: 179 ac (< 1 %) RDS: 0 ac Total: 200 ac (< 1 %)
140200030104	Long Branch Creek	1.2	2.2	1.4	1.4	C: 0 ac NC: 0 ac HTR: 154 ac (1 %) RDS: 0 ac Total: 154 ac (1 %)	C: 0 ac NC: 0 ac HTR: 154 ac (1 %) RDS: 0 ac Total: 154 ac (1 %)
140200020604	Nellie Creek-Henson Creek	1.7	1.9	1.4	1.2	C: 0 ac NC: 0 ac HTR: 43 ac (0 %) RDS: 0 ac Total: 43 ac (0 %)	C: 0 ac NC: 0 ac HTR: 116 ac (0 %) RDS: 0 ac Total: 116 ac (0 %)
140200030509	Outlet Cochetopa Creek	1.6	1.9	1.4	1.4	C: 0 ac NC: 0 ac HTR: 6 ac (0 %) RDS: 0 ac Total: 6 ac (0 %)	C: 0 ac NC: 0 ac HTR: 6 ac (0 %) RDS: 0 ac Total: 6 ac (0 %)
140200030202	Outlet Razor Creek	1.1	2.2	1.7	1.4	C: 0 ac NC: 0 ac HTR: 51 ac (0 %) RDS: 0 ac Total: 51 ac (0 %)	C: 0 ac NC: 0 ac HTR: 51 ac (0 %) RDS: 0 ac Total: 51 ac (0 %)
140200030502	Pauline Creek	1.4	2.2	1.3	1.2	C: 6179 ac (23 %) NC: 4217 ac (16 %) HTR: 429 ac (2 %) RDS: 11 ac (0 %) Total: 10836 ac (41 %)	C: 0 ac NC: 1085 ac (4 %) HTR: 1043 ac (4 %) RDS: 0 ac Total: 2128 ac (8 %)
140200020607	Trout Creek-Lake Fork	1.8	1.7	1.2	1.4	C: 99 ac (0 %) NC: 3341 ac (14 %) HTR: 0 ac RDS: 0 ac Total: 3440 ac (14 %)	C: 59 ac (0 %) NC: 1565 ac (6 %) HTR: 45 ac (0 %) RDS: 0 ac Total: 1669 ac (7 %)

HUC12_Code	HUC12_Name	Aq Phys Score (30 %)	Aq Bio Score (30 %)	Terr Phys Score (30 %)	Terr Bio Score (10 %)	Alt 2 Treatments	Alt 3 Treatments
North Fork Valley Geographic Area							
140200021204	Crawford Reservoir	1.4	2.2	1.4	1.4	C: 364 ac (4 %) NC: 0 ac HTR: 0 ac RDS: 0 ac Total: 364 ac (4 %)	C: 364 ac (4 %) NC: 0 ac HTR: 0 ac RDS: 0 ac Total: 364 ac (4 %)
140200021002	Curecanti Creek	1.6	1.9	1.3	1.2	C: 109 ac (0 %) NC: 0 ac HTR: 155 ac (< 1 %) RDS: 0 ac Total: 264 ac (1 %)	C: 20 ac (0 %) NC: 0 ac HTR: 155 ac (< 1 %) RDS: 0 ac Total: 175 ac (< 1 %)
140200040407	Miller Creek	1.7	1.5	1.8	1.2	C: 0 ac NC: 0 ac HTR: 181 ac (< 1 %) RDS: 0 ac Total: 181 ac (< 1 %)	C: 0 ac NC: 0 ac HTR: 181 ac (< 1 %) RDS: 0 ac Total: 181 ac (< 1 %)
140200040103	Outlet West Muddy Creek	1.3	2.2	1.4	1.1	C: 0 ac NC: 293 ac (1 %) HTR: 174 ac (1 %) RDS: 0 ac Total: 467 ac (2 %)	C: 0 ac NC: 293 ac (1 %) HTR: 174 ac (1 %) RDS: 0 ac Total: 467 ac (2 %)
140200040406	Terror Creek	1.8	1.5	1.7	1.1	C: 559 ac (3 %) NC: 6152 ac (33 %) HTR: 143 ac (< 1 %) RDS: 2 ac (0 %) Total: 6856 ac (36 %)	C: 379 ac (2 %) NC: 4192 ac (22 %) HTR: 388 ac (2 %) RDS: 2 ac (0 %) Total: 4961 ac (26 %)
San Juans Geographic Area							
140300030107	Bear Creek	1.7	1.7	1.4	1.2	C: 0 ac NC: 0 ac HTR: 4 ac (0 %) RDS: 0 ac Total: 4 ac (0 %)	C: 0 ac NC: 0 ac HTR: 4 ac (0 %) RDS: 0 ac Total: 4 ac (0 %)
140200060205	Coal Creek-Uncompahgre River	1.7	1.7	1.4	1.2	C: 0 ac NC: 0 ac HTR: 3 ac (0 %) RDS: 0 ac Total: 3 ac (0 %)	C: 0 ac NC: 0 ac HTR: 3 ac (0 %) RDS: 0 ac Total: 3 ac (0 %)
140300030101	Howard Fork	2	1.7	1.3	1.2	C: 0 ac NC: 0 ac HTR: 2 ac (0 %) RDS: 0 ac Total: 2 ac (0 %)	C: 0 ac NC: 0 ac HTR: 2 ac (0 %) RDS: 0 ac Total: 2 ac (0 %)
140300030102	Lake Fork	2.2	1.4	1.4	1.2	C: 0 ac NC: 0 ac HTR: 15 ac (0 %) RDS: 0 ac Total: 15 ac (0 %)	C: 0 ac NC: 0 ac HTR: 15 ac (0 %) RDS: 0 ac Total: 15 ac (0 %)
140200020902	Upper Cimarron River	1.4	2.2	1.4	1.4	C: 0 ac NC: 0 ac HTR: 43 ac (0 %) RDS: 0 ac Total: 43 ac (0 %)	C: 0 ac NC: 0 ac HTR: 43 ac (0 %) RDS: 0 ac Total: 43 ac (0 %)

HUC12_Code	HUC12_Name	Aq Phys Score (30 %)	Aq Bio Score (30 %)	Terr Phys Score (30 %)	Terr Bio Score (10 %)	Alt 2 Treatments	Alt 3 Treatments
140200060206	West Fork Dallas Creek	1.1	2.2	1.5	1.2	C: 0 ac NC: 0 ac HTR: 2 ac (0 %) RDS: 0 ac Total: 2 ac (0 %)	C: 0 ac NC: 0 ac HTR: 2 ac (0 %) RDS: 0 ac Total: 2 ac (0 %)
Uncompahgre Plateau Geographic Area							
140300040402	Calamity Creek	1.2	2.2	1.4	1.2	C: 0 ac NC: 0 ac HTR: 178 ac (< 1 %) RDS: 0 ac Total: 178 ac (< 1 %)	C: 0 ac NC: 0 ac HTR: 178 ac (< 1 %) RDS: 0 ac Total: 178 ac (< 1 %)
140300030605	Campbell Creek	1.1	2.2	1.5	1.4	C: 0 ac NC: 0 ac HTR: 85 ac (< 1 %) RDS: 0 ac Total: 85 ac (< 1 %)	C: 0 ac NC: 0 ac HTR: 85 ac (< 1 %) RDS: 0 ac Total: 85 ac (< 1 %)
140200050304	East Fork Escalante Creek	1.2	1.7	1.8	1.4	C: 0 ac NC: 0 ac HTR: 525 ac (3 %) RDS: 0 ac Total: 525 ac (3 %)	C: 0 ac NC: 0 ac HTR: 525 ac (3 %) RDS: 0 ac Total: 525 ac (3 %)
140200060501	Headwaters Dry Creek	1.3	1.7	1.8	1.8	C: 6882 ac (20 %) NC: 500 ac (2 %) HTR: 39 ac (0 %) RDS: 7 ac (0 %) Total: 7428 ac (22 %)	C: 6257 ac (18 %) NC: 500 ac (2 %) HTR: 72 ac (0 %) RDS: 7 ac (0 %) Total: 6836 ac (20 %)
140300030203	Lower Horsefly Creek	1.4	1.5	1.8	1.6	C: 495 ac (2 %) NC: 1631 ac (7 %) HTR: 0 ac RDS: 1 ac (0 %) Total: 2127 ac (9 %)	C: 495 ac (2 %) NC: 1631 ac (7 %) HTR: 0 ac RDS: 1 ac (0 %) Total: 2127 ac (9 %)
140200050203	Middle Roubideau Creek	1.3	1.7	1.8	1.6	C: 2369 ac (9 %) NC: 0 ac HTR: 92 ac (0 %) RDS: 1 ac (0 %) Total: 2462 ac (9 %)	C: 0 ac NC: 0 ac HTR: 300 ac (1 %) RDS: 0 ac Total: 300 ac (1 %)
140300030604	Spring Creek	1.2	2.2	1.7	1.1	C: 0 ac NC: 0 ac HTR: 85 ac (<1 %) RDS: 0 ac Total: 85 ac (< 1 %)	C: 0 ac NC: 0 ac HTR: 85 ac (<1 %) RDS: 0 ac Total: 85 ac (< 1 %)

Given the above discussion on potential effects of SBEADMR treatments on the various WCF attributes, watersheds with less than 10 percent of their area affected by SBEADMR treatments can be eliminated from further consideration of potential change in watershed condition class. This is particularly true for those watersheds where the only SBEADMR treatment is removal of hazard trees along roads. Watersheds with less than 10 percent of their area covered by commercial or non-commercial SBEADMR treatments would not experience a change in watershed condition class because the extent of the acres affected would not reach the threshold magnitudes to change the "Riparian/Wetland Vegetation" or "Roads and Trails" indicators/attributes.

Table 5 lists the borderline watersheds that will be further analyzed for watershed condition class change due to SBEADMR treatments.

Table 5. Borderline watersheds with more than 10 % of total watershed area affected by SBEADMR treatments.

Geographic Area	Alternative 2	Alternative 3
Grand Mesa	Headwaters Buzzard Creek	Headwaters Buzzard Creek
Gunnison Basin North	Beaver Creek Lower Taylor River	Beaver Creek Lower Taylor River
Gunnison Basin South	Headwaters Los Pinos Creek Pauline Creek Trout Creek-Lake Fork	--
North Fork Valley	Terror Creek	Terror Creek
San Juans	--	--
Uncompahgre Plateau	Headwaters Dry Creek	Headwaters Dry Creek

Riparian/Wetland Vegetation

As discussed above, the "Riparian/Wetland Vegetation Condition" indicator has one attribute: "Vegetation condition". The potential for SBEADMR treatments to affect the "Riparian/Wetland Vegetation Condition" would depend on the extent that SBEADMR treatment areas overlap with riparian areas. To change the rating for this attribute would require an extensive aerial amount (greater than 25 percent) of impact to riparian vegetation in a watershed due to the percentages in the rule set.

Table 6 list the area of riparian vegetation that intersects or is within 500 feet of an identified SBEADMR treatment area for Alternative 2 and 3 for the borderline watersheds analyzed. In addition, 0.1 mile of new road construction corridor intersects riparian area in the Headwaters Los Pinos watershed. None of these other watersheds have new road corridors that intersect riparian area. The amount of riparian area potentially affected by SBEADMR is less than 2 percent of the watershed area in each of these watersheds. This extent of riparian acres affected would not reach the threshold magnitudes to change the "Riparian/Wetland Vegetation" indicator/attribute and would not change the watershed condition class rating for any of these watersheds.

Table 6. Acres of riparian area that intersect, are within 100 feet or are within 100 – 500 feet of an identified Hazard Tree Removal Corridor or Potential Treatment Area by Alternative for the Borderline Watersheds Analyzed

HUC 12 Code	HUC 12 Watershed Name	Alternative 2				Alternative 3			
		Intersect (acres)	< 100 ft (acres)	100 – 500 ft (acres)	Total[1] (acres) (%)	Intersect (acres)	< 100 ft (acres)	100 – 500 ft (acres)	Total[1] (acres) (%)
Grand Mesa Geographic Area									
140100051102	Headwaters Buzzard Creek	55	25	125	205 (1 %)	55	25	123	203 (1 %)
Gunnison Basin North									
140200010112	Beaver Creek	383	12	28	423 (2 %)	220	11	40	271 (1 %)

HUC 12 Code	HUC 12 Watershed Name	Alternative 2				Alternative 3			
		Intersect (acres)	< 100 ft (acres)	100 – 500 ft (acres)	Total[1] (acres) (%)	Intersect (acres)	< 100 ft (acres)	100 – 500 ft (acres)	Total[1] (acres) (%)
140200010113	Lower Taylor River	142	13	73	228 (< 1 %)	142	13	73	228 (< 1 %)
Gunnison Basin South									
140200030504	Headwaters Los Pinos	89	87	235	411 (1 %)	--	--	--	--
140200030502	Pauline Creek	30	75	332	437 (2 %)	--	--	--	--
140200020607	Trout Creek-Lake Fork	100	7	6	113 (0 %)	--	--	--	--
North Fork Valley									
140200040406	Terror Creek	100	9	32	141 (< 1 %)	69	13	31	113 (< 1 %)
Uncompahgre Plateau									
140200060501	Headwaters Dry Creek	58	10	23	91 (0 %)	54	9	24	87 (0 %)

[1] Percent of total watershed area

Roads and Trails

As discussed above, the "Roads and Trails" indicator has four attributes: "Open road density", "Road and trail maintenance", "Proximity to water", and "Mass wasting". In order to change the overall watershed condition score, more than one of these attributes would need to change in the negative direction because of the small influence any one of these attributes alone has. The "Road and trail maintenance" attribute is not going to change in the negative direction because of SBEADMR; the road reconstruction and road maintenance would generally be a benefit to watershed condition as road drainage and surface stabilization would be improved and, in some cases, roads located near waterbodies would be moved to outside the WIZ. The "Mass wasting" attribute is also not going to change because areas subject to mass wasting would be identified with the pre-treatment checklist so that these areas would be avoided when locating roads. The "Open road density" and "Proximity to water" attributes potentially could be changed by SBEADMR depending on the amount of new roads built in a watershed and their proximity to waterbodies.

Table 7 lists the current attribute scores for the "Roads and Trails" indicator for these eight borderline watersheds. In five of the eight watersheds, the "Proximity to water" attribute is already rated as "3", so new SBEADMR roads are not going to change this attribute, even if all of them were constructed within the WIZ. The "Open road density" attribute is rated as either "1" or "2" for each of these watersheds, so there is potential for change.

Table 7. Current Attribute Scores for the "Roads and Trails" Indicator for the Borderline Watersheds Analyzed

HUC12 Name	Road/Trail Class	Road/Trail Score	Open Road Density	Road Maintenance	Proximity to Water	Mass Wasting
Beaver Creek	2	1.8	1	2	3	1
Lower Taylor River	2	1.8	1	2	3	1

HUC12 Name	Road/Trail Class	Road/Trail Score	Open Road Density	Road Maintenance	Proximity to Water	Mass Wasting
Headwaters Los Pinos Creek	2	1.8	2	1	3	1
Pauline Creek	1	1.5	2	1	2	1
Trout Creek-Lake Fork	1	1.3	1	1	2	1
Headwaters Buzzard Creek	2	1.8	1	2	3	1
Terror Creek	3	2.3	2	3	3	1
Headwaters Dry Creek	2	1.8	2	2	2	1

Table 8 shows the existing road miles on NFS lands and within 100 feet of a waterbody, the current "Open road density" and "Proximity to water" attribute ratings, existing road density, and the new roads to be constructed or reconstructed under SBEADMR. As new roads constructed for Alternative 3 are a subset of those in Alternative 2, Alternative 3 is not shown in the table.

Table 8. SBEADMR new road construction effects on "Open road density" and "Proximity to water" attributes for the borderline watersheds analyzed

HUC12 Name	Existing Road Miles	Open Road Density				Proximity to Water (miles of road within 100 feet)		
		Current Density (mi/mi^2)	Current Rating	Alt 2[1] (miles)	Alt 2 Density (mi/mi^2)	Current Rating	Existing Roads	Alt 2
Grand Mesa								
Headwaters Buzzard Creek	22.1	0.7	1	0	0.7	3	2.2	0
Gunnison Basin North								
Beaver Creek	22.6	0.8	1	0.1	0.8	3	3.4	0
Lower Taylor River	50.8	0.8	1	0	0.8	3	20.3	0
Gunnison Basin South								
Headwaters Los Pinos Creek	72.1	1.4	2	12.3	1.7	3	14.0	0.4
Pauline Creek	81.4	2.0	2	11.7	2.27	2	7.0	0.2
Trout Creek-Lake Fork	14.8	0.4	1	0.3	0.4	2	0.8	0
North Fork Valley								
Terror Creek	38.4	1.3	2	1.5	1.4	3	13.1	0
Uncompahgre Plateau								
Headwaters Dry Creek	53.3	1.0	2	14.8	1.3	2	2.0	0.3

[1] New roads includes construction and reconstruction.

Assuming the "new road" miles in Table 8 is all new construction, these new road miles would increase the road density in four of the eight borderline watersheds (Headwaters Los Pinos, Pauline Creek, Terror Creek, and Headwaters Dry Creek). These four watersheds are already rated as a "2" for "Open road Density". The increase in density would not reach the threshold value of "2.4 mi/mi^2" that would change the rating from "2" to "3". Very few new roads would be built within the WIZ (100 feet from the

waterbody).   This small amount of new road would not change the "Proximity to water" attribute in any of these borderline watersheds.

Because the new SBEAMR roads would not change any of the "Roads and Trails" attributes, the rating for this indicator would not change either and therefore there would be no change in overall watershed condition score or rating in these borderline watersheds.

Conclusion

This analysis examined the potential direct and indirect effects of the SBEADMR treatments on the watershed condition class ratings. Each element (indicators and attributes) of the Watershed Condition Framework were evaluated and how SBEADMR treatments could affect those ratings was analyzed. This analysis concluded that SBEADMR treatment could potentially change the ratings for the "Riparian/Wetland Vegetation" and "Roads and Trails" indicators if the areal extent of the SBEADMR treatments in a watershed were great enough. The analysis also concluded that, given the percentage change required in these indicators to change the overall watershed condition score, the only watersheds where the watershed condition class could potentially be changed by SBEADMR treatments are those which currently have a watershed condition score of 1.6, that is, the "borderline" Class 1/Class 2 watersheds.

Of the 188 watersheds on the GMUG with identified SBEADMR treatments, 42 are borderline Class 1/Class 2. Of these 42, SBEADMR treatments exceed 10 percent of the total watershed area in only 8 watersheds. The potential effects of SBEADMR treatments in these 8 watersheds on the "Riparian/Wetland Vegetation" and "Roads and Trails" indicators was analyzed in detail.

This analysis concluded:

▪ SBEADMR treatments would not affect watershed condition in the non-borderline watersheds (74 Class 1, 70 Class 2 and 2 not rated) because SBEADMR treatments are unlikely to change the ratings of enough WCF attributes such that the overall watershed condition score would change sufficiently to change the condition class from "1" to "2" or "2" to "3".

▪ Watershed condition score in the borderline watersheds is sufficiently close to the line such that a change in one or two WCF attribute ratings could result in a change in the watershed condition score to place the watershed in Class 2.

▪ Of the 12 indicators and 24 attributes, SBEADMR treatments only have the potential to affect the ratings for "Riparian/Wetland Vegetation" and "Roads and Trails" indicators and change watershed condition score sufficient to change the watershed condition class rating of a borderline watershed.

▪ In 34 of the 42 borderline watersheds, the SBEADMR treatments is less than 10 percent of the total watershed area. This magnitude of treatments would not change the ratings for the "Riparian/Wetland Vegetation" or "Roads and Trails" indicators and therefore would not change the watershed condition class rating of these watersheds.

▪ In the remaining 8 borderline watersheds, the "Riparian/Wetland Vegetation Condition", "Open Road Density" and "Proximity to Water" attributes were examined in detail. While there is some potential to affect riparian vegetation and new roads would increase road density in some of these watersheds, that magnitude of the activity would not be sufficient to change the ratings of these attributes in these watersheds. Therefore, watershed condition class for these borderline watersheds would not change because of SBEADMR treatments.

Part 2. Cumulative Watershed Effects Analysis Data Summary

The following watersheds are not included in the cumulative impacts tables below because the only SBEADMR treatments would be a small amount of hazard tree removal (HTR). This level of disturbance would not result in any cumulative watershed effects in any of these watersheds.

HUC 12 Code	HUC 12 Name	Acres of HTR	HUC 12 Code	HUC 12 Name	Acres of HTR
Grand Mesa			*San Juans*		
140200050114	Dry Gulch-Gunnison River[1]		140300030107	Bear Creek	4
140200050112	Negro Creek-Tongue Creek	22	140200060208	Beaver Creek-Dalles Creek	16
140200050703	North Fork Kannah Creek	10	140200060205	Coal Creek-Uncompahgre R	3
140100051202	Vega Reservoir	7	140300030105	Deep Creek	15
Gunnison Basin North			140300020103	Fish Creek	1
140200010208	Alkali Creek	1	140300030101	Howard Fork	2
140200020106	Lower Ohio Creek	18	140300030102	Lake Fork	15
140200030305	Lower Quartz Creek	11	140200060201	Red Mountain Creek	15
140200010103	Middle Taylor River	11	140200060206	West Fork Dallas Creek	2
140200010107	Taylor Park Reservoir	10	*Uncompahgre Plateau*		
Gunnison Basin South			140300030706	Atkinson Creek	19
130100040301	Bear Creek-Sheep Creek	1	140300030702	Bucktail Creeks-San Miguel R	31
130100040102	Horse Canyon	4	140300010301	Headwaters Little Delores R	9
140200020602	Lake Sanc Cristobal-Lake Fork	17	140300040404	Maverick Canyon	2
140200030509	Outlet Cochetopa Creek	6	140300030402	McKee Draw	1
140200020503	Rough Creek-Cebolla Creek	20	140200050303	North Fork Escalante Creek	1
North Fork Valley			140300040302	North Lobe Creek-West Creek	14
140200040307	Anthracite Creek	10	140200050404	Rocky Pitch Gulch-Dominguez Creek	10
140200040202	Clear Fork East Muddy Cr	1	140300040304	Ute Creek-West Creek	28
140200040402	Raven Gulch	178			
140200040303	Robinson Creek	3			
140200021201	Upper Smith Fork	23			

[1] Dry Gulch-Gunnison River watershed was not included in the cumulative effects analysis because of the small percentage (approximately 4%) of the watershed area in NFS lands.

The potential for cumulative watershed effects from SBEADMR activities was analyzed in the watersheds containing identified SBEADMR treatment areas. The following tables list the result of this analysis by Geographic Area. The analysis used weighting factors to add the amount of existing (baseline) disturbance, the maximum proposed SBEADMR disturbance as reflected in Alternative 2, and identified reasonably foreseeable future disturbances in each watershed. This total was then divided by the amount (acres) of National Forest System (NFS) lands in the watershed to determine the amount of watershed potentially affected. If the computed percent of NFS lands impacted equaled or exceeded 20 percent, the watershed was further analyzed with refined weighting factors.

Table 9. Cumulative Watershed Effects Analysis Data for Grand Mesa Watersheds

HUC12 Code	HUC12 Name	Total Acres	NFS Acres	Baseline Disturbance			SBEADMR Maximum Proposed Additional Disturbance				Future Disturbance	Cumulative Disturbance	
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140100051302	Big Creek	20,351	15,172	243	726	969	531	4	1	536		10%	
140100051305	Bull Creek	14,626	8,914	30	5	34	353	4	0	357	25	5%	
140100051307	Coon Creek	11,362	3,949	24	33	57	229	0	0	229		7%	
140100051304	Cottonwood Creek	14,301	11,024	107	118	225	489	3	0	492	37	7%	
140200050107	Dirty George Creek	20,206	9,639	57	32	89	902		0	902		10%	
140100051301	Grove Creek	16,563	5,358	33	113	146	196	1	0	197		6%	
140100051102	Headwaters Buzzard Creek	21,479	21,475	138	89	228	537		0	537		4%	
140200050702	Headwaters Kannah Creek	38,139	37,527	176	1,467	1,643	453	2	0	456		6%	
140100051103	Hightower Creek-Buzzard Creek	17,936	16,673	155	730	885	1,144		0	1,144	15	12%	
140200050106	Kiser Creek	21,784	8,806	342	241	583	557	1	0	557	38	13%	
140100051201	Leon Creek	28,684	27,640	119	86	205	131		0	131	5	1%	
140100051308	Mesa Creek	21,663	7,814	135	135	270	1,268	1	0	1,269		20%	Yes
140200050109	Oak Creek	14,297	4,871	36	306	343	407		0	407		15%	
140100051101	Owens Creek	10,334	10,030	99	223	321	90		0	90		4%	
140200050111	Surface Creek	29,311	19,519	172	118	290	765	0	0	765	37	6%	
140200050108	Ward Creek	14,793	9,018	115	135	250	31	0	0	31	96	4%	
140200050706	Whitewater Creek	30,688	3,627	34	99	133	24		0	24		4%	

Table 10. Cumulative Watershed Effects Analysis Data for Gunnison Basin North Watersheds

HUC12 Code	HUC12 Name	Total Acres	NFS Acres	Baseline Disturbance			SBEADMR Maximum Proposed Additional Disturbance				Future Disturbance	Cumulative Disturbance	
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140200030102	Agate Creek Total*	15,139	14,880	102	20	122	489		0	489		4%	
140200030304	Alder Creek	10,991	7,932	42	366	408	39		0	39	4	6%	
140200020201	Antelope Creek	21,030	4,529	84	283	367	76	2	2	80	280	16%	
140200010111	Bear Creek-Spring Creek	23,119	22,566	168	196	364	226	3	0	229	1,320	8%	
140200010112	Beaver Creek	18,310	16,121	80	937	1,017	1,740		0	1,740	554	21%	Yes
140200020401	Beaver Creek	23,115	17,332	14	18	32	13	0	0	14		0%	
140200010202	Brush Creek	24,476	24,299	76	0	76	59		0	59	1	1%	
140200030602	Cabin Creek	10,107	2,996	48	233	281	306		0	306	80	22%	Yes
140200020103	Carbon Creek	16,053	10,288	45	0	45	260	2	0	262		3%	
140200010207	Cement Creek	22,850	21,710	133	53	187	47	5	0	52		1%	
140200010204	Coal Creek	13,147	10,083	100	55	155	357	10	1	367		5%	
140200021003	Corral Creek-Gunnison River	13,400	3,578	52	430	483	17		0	17	173	19%	
140200020705	Cow Creek-Soap Creek	24,267	23,207	152	1,379	1,531	14		0	14	457	9%	
140200020701	East Elk Creek	14,154	10,197	141	654	796	55		0	55	9	8%	
140200030302	Gold Creek	19,356	16,056	96	55	150	456	0	0	456	3	4%	
140200030101	Headwaters Tomichi Creek	17,989	16,352	165	134	300	50		0	50		2%	
140200010105	Headwaters Willow Creek	16,100	14,101	113	83	197	8		0	8		1%	
140200030404	Hot Springs Creek	28,903	17,061	387	734	1,121	1,865		0	1,865		18%	
140200010108	Lottis Creek	26,954	25,883	118	34	152	13		0	13		1%	
140200010210	Lower East River	27,747	13,745	89	64	153	11		0	11		1%	
140200010113	Lower Taylor River	39,290	35,324	1,692	2,131	3,823	425		0	425	1,551	16%	

HUC12 Code	HUC12 Name	Total Acres	NFS Acres	Baseline Disturbance			SBEADMR Maximum Proposed Additional Disturbance				Future Disturbance	Cumulative Disturbance	
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140200010203	Middle East River	16,676	13,768	75	128	204	161	6	2	169	102	3%	
140200020105	Middle Ohio Creek	19,522	7,130	28	0	28	45	0	0	45		1%	
140200030303	Middle Quartz Creek	17,870	13,131	173	92	266	1,030		0	1,030	128	11%	
140200020104	Mill Creek	10,667	8,056	18	102	121	21		0	21	44	2%	
140200010205	Oh-be-Joyful Creek-Slate River	21,472	16,447	69	0	69	11		0	11		0%	
140200010106	Outlet Willow Creek	24,521	23,612	282	280	562	21		0	21	2	2%	
140200030401	Owens Creek-Tomichi Creek	23,263	20,866	151	1,081	1,232	748		0	748		9%	
140200030105	Porphyry Creek-Tomichi Creek	25,105	20,217	176	665	841	348		0	348		6%	
140200020702	Red Creek	9,094	5,055	61	391	452	138		0	138	15	12%	
140200010110	Rocky Brook-Spring Creek	20,890	20,850	261	389	651	553	1	0	555	365	8%	
140200030601	Sewell Gulch-Tomichi Creek	15,164	1,896	20	134	154	73		0	73	15	13%	
140200020107	Sheep Gulch-Gunnison River	26,255	9,412	182	662	845	1,067		0	1,067	112	22%	Yes
140200020402	Steuben Creek	16,499	12,804	59	35	94	61		0	61	561	6%	
140200010104	Texas Creek	25,922	25,839	111	25	135	13		0	13		1%	
140200010102	Trail Creek-Upper Taylor River	18,447	18,169	197	373	570	21		0	21	35	3%	
140200010201	Upper East River	17,207	16,674	76	0	76	5		0	5		0%	
140200020101	Upper Ohio Creek	15,506	12,755	41	38	79	105	1	0	106		1%	
140200030301	Upper Quartz Creek	25,889	23,477	339	202	541	343	3	2	348		4%	
140200010101	Upper Taylor River	39,869	39,225	211	31	242	45		0	45		1%	
140200010206	Washington Gulch-Slate River	22,977	10,782	41	27	68	106	6	0	112		2%	
140200020403	Willow Creek-Blue Mesa Reservoir	42,361	7,702	123	215	338	939		0	939	160	19%	
140200030405	Wood Gulch-Tomichi Creek	22,880	2,175	35	1	36	513		0	513		25%	Yes

Table 11. Cumulative Watershed Effects Analysis Data for Gunnison Basin South Watersheds

HUC12 Code	HUC12 Name	Total Acres	NFS Acres	Baseline Disturbance			SBEADMR Maximum Proposed Additional Disturbance				Future Disturbance	Cumulative Disturbance	
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140200030506	140200030506	9,912	1,653	15	0	15	298		0	298		**19%**	
140200030503	Archuleta Creek	37,552	24,534	970	279	1,249	640	13	2	655	223	**9%**	
140200030403	Barret Creek-Tomichi Creek	32,600	12,339	122	137	259	20		0	20	**111**	**3%**	
140200020606	Elk Creek-Lake Fork	35,597	19,316	23	83	105	235		0	235		**2%**	
140200020801	Headwaters Blue Creek	26,873	26,873	63	75	138	570		2	572		**3%**	
140200020502	Headwaters Cebolla Creek	19,310	18,025	210	283	493	539	2	0	541	61	**6%**	
140200030501	Headwaters Cochetopa Creek	31,713	30,748	62	9	71	124		0	114		**1%**	
140200030504	Headwaters Los Pinos Creek	32,085	31,698	342	1,003	1,346	1,360	7	0	1,347	**302**	**10%**	
140200030201	Headwaters Razor Creek	24,686	22,161	134	230	364	219		0	219	90	**3%**	
140200020202	Headwaters South Beaver Creek	21,434	16,515	46	0	46	7		0	7	**103**	**1%**	
140200020802	Little Blue Creek	22,327	2,479	41	308	350	119	0	2	122		**19%**	
140200030104	Long Branch Creek	15,504	15,277	37	204	241	32		0	32		**2%**	
140200030103	Marshall Creek	36,742	33,603	533	1,745	2,278	1,258	1	4	1,263	200	**11%**	
140200020501	Mill Creek-Brush Creek	19,123	17,834	76	161	237	117	0	0	117		**2%**	
140200030402	Needle Creek	11,491	10,217	43	453	496	7		0	7		**5%**	
140200020604	Nellie Creek-Henson Creek	30,782	11,589	16	0	16	27		0	27		**0%**	
140200020603	North Fork Henson Creek-Henson Creek	22,714	6,249	17	0	17	11		0	11		**0%**	
140200030202	Outlet Razor Creek	18,852	3,892	58	0	58	11		0	11		**2%**	
140200030502	Pauline Creek	26,481	24,904	374	1,571	1,945	1,620	10	1	1,631		**14%**	
140200021001	Pine Creek	373	112	3	0	3	11	0	0	11		**13%**	
140200020506	Rock Creek	26,268	5,946	42	0	42	249	3	0	252		**5%**	

Appendix I – Watershed Condition Class & Cumulative Effects Analysis
Spruce Beetle Epidemic and Aspen Decline Management Response

HUC12 Code	HUC12 Name	Total Acres	NFS Acres	Baseline Disturbance			SBEADMR Maximum Proposed Additional Disturbance				Future Disturbance	Cumulative Disturbance	
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total[4]	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140200030508	Rock Creek-Cochetopa Creek	23,762	7,497	54	0	54	20		0	20	**321**	**5%**	
140200040301	Ruby Anthracite Creek	32,680	29,587	80	5	85	128	5	0	133		**1%**	
140200020504	Spring Creek	23,225	20,390	80	334	415	206	1	0	207		**3%**	
140200030505	Trail Creek-Cochetopa Creek	24,046	11,055	41	422	464	264		0	264	**544**	**12%**	
140200020607	Trout Creek-Lake Fork	24,597	5,640	33	290	323	585		0	585		**16%**	
140200030507	West Pass Creek	31,859	27,363	530	1,265	1,795	331	1	1	334	549	**10%**	
140200020610	Willow Creek	14,784	1,940	23	178	201	129	4	1	135		**17%**	

Table 12. Cumulative Watershed Effects Analysis Data for North Fork Valley Watersheds

HUC12 Code	HUC12 Name	Total Acres	NFS Acres	Baseline Disturbance			SBEADMR Maximum Proposed Additional Disturbance				Future Disturbance	Cumulative Disturbance	
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total[4]	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140200040403	Bear Creek-North Fork Gunnison River	12,286	12,170	59	0	59	39		0	39		**1%**	
140200040403	Bear Creek-North Fork Gunnison River	30,289	10,934	53	1	54	29		0	29		**1%**	
140200040101	Cow Creek	11,435	11,153	60	41	101	272	3	0	275		**3%**	
140200021204	Crawford Reservoir	10,303	1,020	15	6	21	90		0	90		**11%**	
140200021004	Crystal Creek	36,987	28,472	154	342	495	295	4	0	299		**3%**	
140200021002	Curecanti Creek	25,226	20,614	55	14	69	59	0	0	60	**372**	**2%**	
140200040404	Headwaters Hubbard Creek	13,194	12,717	96	143	239	387	3	0	390		**5%**	
140200040505	Headwaters Leroux Creek	28,416	22,185	89	94	183	54		0	54		**1%**	
140200040102	Headwaters West Muddy Creek	20,251	18,802	131	69	200	601	2	0	604		**4%**	
140200040203	Lee Creek	13,813	11,474	22	0	22	5		0	5		**0%**	

Appendix I – Watershed Condition Class & Cumulative Effects Analysis
Spruce Beetle Epidemic and Aspen Decline Management Response

| HUC12 Code | HUC12 Name | Total Acres | NFS Acres | Baseline Disturbance | | | SBEADMR Maximum Proposed Additional Disturbance | | | | Future Disturbance | Cumulative Disturbance | |
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140200040204	Little Henderson Creek-East Muddy Creek	37,632	21,048	90	83	173	291	1	0	292	10	2%	
140200040201	Little Muddy Creek	10,364	9,347	90	0	90	32		0	32		1%	
140200021005	Mesa Creek-Gunnison River	31,772	12,868	324	188	512	164	3	0	167		5%	
140200021205	Middle Smith Fork	21,586	13,669	36	369	405	25	1	0	26		3%	
140200040407	Miller Creek	34,746	21,121	128	901	1,029	38		0	38		5%	
140200021202	Muddy Creek	15,256	3,452	28	0	28	13		0	13		1%	
140200040306	Outlet Clear Creek	12,908	12,695	48	11	59	33		0	33		1%	
140200040405	Outlet Hubbard Creek	23,895	13,639	138	162	300	1,218		0	1,218		11%	
140200040103	Outlet West Muddy Creek	31,024	21,568	134	4	138	110		0	110	44	1%	
140200040406	Terror Creek	18,829	13,976	261	410	671	1,290	2	0	1,292	45	14%	

Table 13. Cumulative Watershed Effects Analysis Data for San Juans Watersheds

| HUC12 Code | HUC12 Name | Total Acres | NFS Acres | Baseline Disturbance | | | SBEADMR Maximum Proposed Additional Disturbance | | | | Future Disturbance | Cumulative Disturbance | |
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140300030108	Fall Creek	26,850	13,181	73	3	76	237	1	0	238		2%	
140200060203	Headwaters Uncompahgre River	25,818	17,484	141	2	143	34		0	34	**14**	1%	
140300030302	Headwaters Beaver Creek	23,546	22,212	221	437	659	901	10	1	912		7%	
140200060101	Headwaters Cow Creek	31,776	27,742	22	112	134	36		0	36		1%	
140200020903	Headwaters Little Cimarron River	27,413	17,580	87	500	588	330	6	6	342		5%	
140300030401	Headwaters Naturita Creek	56,071	15,625	105	497	602	155	4	0	159	**7**	5%	
140300030106	Headwaters San	33,071	18,905	530	1	531	516		0	516		6%	

Appendix I – Watershed Condition Class & Cumulative Effects Analysis
Spruce Beetle Epidemic and Aspen Decline Management Response

| HUC12 Code | HUC12 Name | Total Acres | NFS Acres | Baseline Disturbance | | | SBEADMR Maximum Proposed Additional Disturbance | | | | Future Disturbance | Cumulative Disturbance | |
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
	Miguel River												
140200060102	Lou Creek-Cow Creek	37,328	12,269	54	0	54	42		0	42		1%	
140300030301	Saltado Creek	12,953	1,861	17	10	27	205	1	0	206		13%	
140200020901	Silver Jack Reservoir-Cimarron River	37,710	37,640	103	68	171	125	0	0	125		1%	
140300030103	South Fork San Miguel River	11,933	7,269	329	44	372	21		0	21		5%	
140300030305	Specie Creek-San Miguel River	24,682	6,597	42	177	219	157	0	0	157	147	8%	
140300030303	Turner Creek-Beaver Creek	25,586	4,982	53	140	193	136	7	0	143		7%	
140200020902	Upper Cimarron River	18,973	8,515	40	16	56	9		0	9		1%	

Table 14. Cumulative Watershed Effects Analysis Data for Uncompahgre Plateau Watersheds

| HUC12 Code | HUC12 Name | Total Acres | NFS Acres | Baseline Disturbance | | | SBEADMR Maximum Proposed Additional Disturbance | | | | Future Disturbance | Cumulative Disturbance | |
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140300040403	Blue Creek	24,685	12,491	71	89	160	43		0	43	50	2%	
140300040402	Calamity Creek	30,081	19,199	144	1,360	1,504	38		0	38	205	9%	
140300030605	Campbell Creek	17,723	7,309	20	509	529	19		0	19		7%	
140300030306	Clay Creek	15,604	13,720	160	168	327	577		0	577	304	9%	
140200050204	Cottonwood Creek	29,988	9,652	392	470	863	70		0	70	130	11%	
140300030701	Cottonwood Creek	32,749	26,848	344	1,576	1,920	984		0	984		11%	
140200050305	Dry Fork Escalante Creek	30,933	15,795	354	815	1,168	236		0	236	243	10%	
140200050302	East Fork Escalante Creek	15,210	13,572	39	73	112	327		0	327		3%	
140200050304	East Fork Escalante Creek	20,443	19,023	554	274	829	114		0	114	273	6%	

HUC12 Code	HUC12 Name	Total Acres	NFS Acres	Baseline Disturbance			SBEADMR Maximum Proposed Additional Disturbance				Future Disturbance	Cumulative Disturbance	
				Infrastructure Disturbance Total[1]	Past Vegetation Treatments[2]	Baseline Total	PTAs & Hazard Trees[2]	New Roads, no past disturbance[1]	New Roads, past disturbance[3]	Additional impact total	Reasonably Foreseeable Disturbances (NFS lands)[4]	% of NFS lands impacted[5]	>/= 20%
140200060403	Happy Canyon Creek	38,456	4,673	51	362	413	431		0	431		18%	
140200060501	Headwaters Dry Creek	33,992	10,980	228	473	701	1,538	3	4	1,546		20%	Yes
140300030602	Headwaters Tabeguache Creek	27,263	25,713	215	1,273	1,488	1,055		0	1,055		10%	
140300040301	Headwaters West Creek	32,705	20,333	103	17	120	8		0	8	519	3%	
140300030203	Lower Horsefly Creek	25,030	21,034	274	1,771	2,045	353	1	0	354	102	12%	
140300030304	McKenzie Creek	30,342	12,499	220	615	835	142		0	142	488	12%	
140200050301	Middle Fork Escalante Creek	21,508	20,804	64	480	545	784		0	784	54	7%	
140300030202	Middle Horsefly Creek	17,876	16,971	189	487	676	1,085	2	0	1,087	29	11%	
140200050203	Middle Roubideau Creek	27,986	18,116	94	195	289	541	1	0	541		5%	
140200060602	Middle Spring Creek	21,667	1,488	60	142	202	98		0	98	26	22%	Yes
140300040101	North Fork Mesa Creek	35,216	12,066	128	372	501	27		0	27	82	5%	
140300030601	North Fork Tabeguache Creek	11,624	11,624	114	327	441	106		0	106	23	5%	
140200050202	Potter Creek	36,584	20,516	310	653	964	384	0	0	384	398	9%	
140200050401	Smith Creek-Big Dominguez Creek	22,878	20,567	189	272	462	1,008		0	1,008	195	8%	
140300040102	South Fork Mesa Creek-Mesa Creek	30,345	6,417	52	125	177	51		0	51	114	5%	
140300030604	Spring Creek	13,504	4,643	51	0	51	19		0	19		1%	
140300030201	Upper Horsefly Creek	29,058	11,830	140	285	425	2,555		0	2,555		25%	Yes
140200050201	Upper Roubideau Creek	33,346	32,856	197	584	780	1,780	6	1	1,788		8%	
140200060601	Upper Spring Creek	16,999	15,411	253	927	1,181	1,768	5	5	1,778	137	20%	

[1] Existing infrastructure disturbance and new roads acres were weighted as 100% disturbance (1 acre = 1 acre in the calculation)

[2] Past vegetation disturbance and new SBEADMR vegetation disturbance (PTAs and hazard trees) were weighted as 25% disturbance (4 acres = 1 acre in the calculation) – numbers in the tables are already discounted

[3] New SBEADMR roads constructed on past vegetation disturbance count as 100% disturbance and the previous vegetation disturbance is removed from the calculation

[4] Reasonably foreseeable future disturbances are vegetation disturbances and count as 25% disturbance (4 acres = 1 acre in calculation) – numbers in the tables are already discounted

[5] [% of NFS lands impacted = (Baseline Total + Additional Impact Total + Reasonably Foreseeable Disturbances) / NFS acres] – result is expressed as a percentage

Recognizing that the first step of the Cumulative Watershed Effects analysis is an overestimation because of the weighting given to noncommercial vegetation disturbances, the analysis was refined for those watersheds with greater than 20 % cumulative disturbance identified in step one. In the refined analysis, the weighting of noncommercial vegetation disturbances is changed from 25% to 10% to reflect the fact that these treatments cause less soil disturbance and local hydrologic effects.

Table 15. Refined Cumulative Watershed Effects Analysis for Watersheds with 20% or more Cumulative Disturbance

HUC 12 Number	HUC 12 Name	NFS acres	Baseline Total[1]	SBEADMR Maximum Proposed Additional Disturbance						Future Disturbance	Cumulative Disturbance	
				Original - PTAs & Hazard Trees[2]	Noncommercial PTA[3]	Revisited Noncommercial PTA impact[4]	Revisited Commercial PTAs & Hazard Trees impact[5]	New Roads (no past disturbance and past disturbance)	Revisited Additional impact total[6]	Reasonably Foreseeable Disturbances (NFS lands)	Revisited: % NFS lands impacted[7]	>/=20%
Grand Mesa												
140100051308	Mesa Creek	7,814	270	1,268	1,246	498	22	1	521	0	**10%**	n/a
Gunnison Basin North												
140200010112	Beaver Creek	16,121	1,017	1,740	1,740	696	0	**0**	696	554	**14%**	n/a
140200030602	Cabin Creek	2,996	281	306	297	119	9	0	128	**80**	**16%**	n/a
140200020107	Sheep Gulch-Gunnison River	9,412	845	1,067	1,067	427	0	0	427	**112**	**15%**	n/a
140200030405	Wood Gulch-Tomichi Creek	2,175	36	513	510	204	3	0	207	0	**11%**	n/a
Uncompahgre Plateau												
140200060501	Headwaters Dry Creek	10,980	701	1,538	102	41	1,436	7	1,485	**0**	**20%**	Yes
140200060602	Middle Spring Creek	1,488	202	98	93	37	5	0	42	**26**	**18%**	n/a
140300030201	Upper Horsefly Creek	11,830	425	2,555	2,442	977	113	0	1,090	0	**13%**	n/a
140200060601	Upper Spring Creek	15,411	1,181	1,768	618	247	1,150	**10**	1,407	137	**18%**	n/a

[1] Baseline Total = weighted acres of past disturbance in watershed

[2] Original PTAs & Hazard Trees = SBEADMR proposed acres of Commercial and Noncommercial PTAs and Hazard Trees weighted as 25% disturbance (4 acres = 1 acre in the calculation) – numbers in the tables are already discounted

[3] Noncommercial PTA = acres of Noncommercial PTA proposed weighted as 25% disturbance

[4] Revisited Noncommercial PTA impact = acres of Noncommercial PTA proposed weighted as 10% disturbance (10 acres = 1 acre in the calculation)

[5] Revisited Commercial PTA and Hazard Tree impact = Original PTAs & Hazard Trees – Noncommercial PTA

[6] Revisited Additional Impact Total = Revisited Noncommercial PTA Impact + Revisited Commercial PTAs & Hazard Trees Impact + New Roads

[7] Revisited % NFS lands impacted = (Baseline Total + Revisited Additional Impact Total + Reasonably Foreseeable Disturbances) / NFS acres